REPORT R95/2011

REVIEW OF THE FLUORSPAR INDUSTRY IN THE REPUBLIC OF SOUTH AFRICA, 2011

DIRECTORATE: MINERAL ECONOMICS

mineral resources

Department:
Mineral Resources
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ABSTRACT

The aim of this report is to review the fluorspar industry in the Republic of South Africa. This is achieved by outlining the structure of the industry on a national and international scale. The report covers the local and international minerals related economic information regarding the availability, exploitation, marketing and utilisation of fluorspar. The trade discussions cover the recent global developments on export duties and export quotas. Market analysis was conducted to establish price trends and demand and supply dynamics. The report also gives an update on recent developments in the South African fluorspar industry with specific reference to downstream value addition of locally produced minerals. The South African government primary goal is to create a fluorochemical beneficiation hub in the country on the back of growing regional demand for fluorochemical products. The report concludes by forecasting demand and consumption growth of fluorspar and the market orientation with respect to world trade together with the expected benefits of beneficiation.

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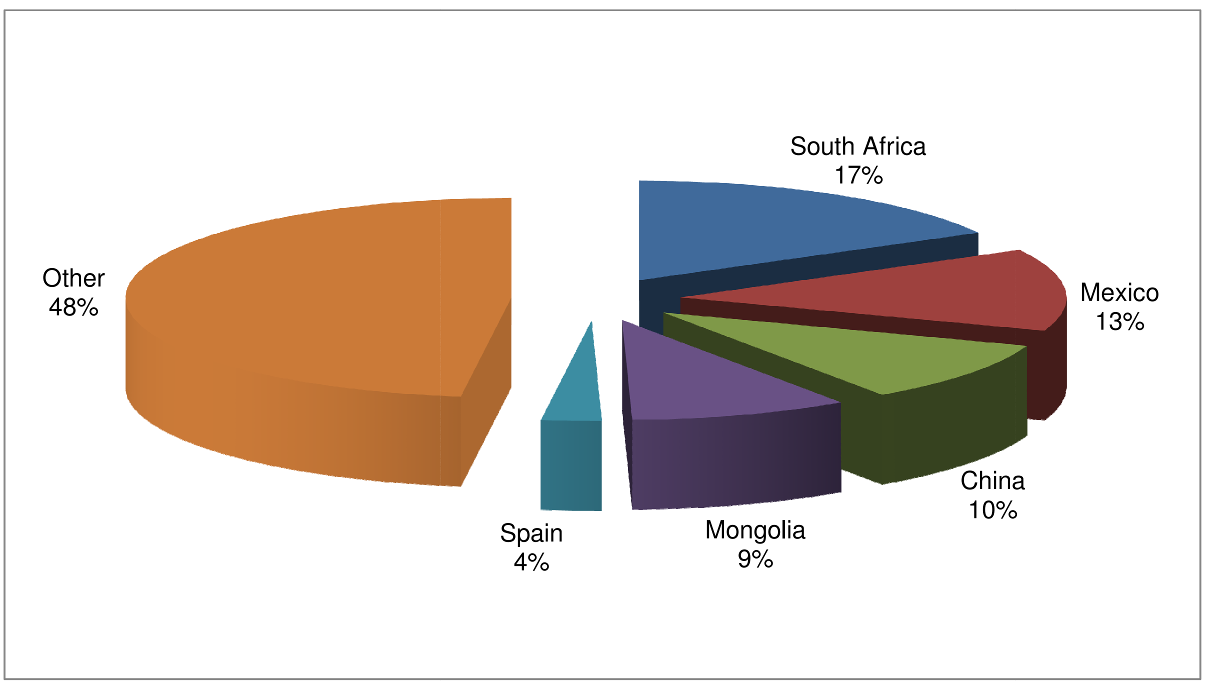
1. INTRODUCTION

Fluorspar is the commercial name for the mineral fluorite (calcium fluoride, CaF_2). When pure it consists of 51.1 percent calcium and 48.9 percent fluorine. Fluorine is found in small amounts in a wide variety of minerals, such as apatite and phlogopite. Fluorite generally appears in a wide range of colours and usually contains mineral impurities such as calcite, quartz, barites, various sulphides and phosphates. Commercial fluorspar is graded according to quality and specification into acid grade (min. 97 percent CaF_2), ceramic grade (min. 80-96 percent CaF_2) and metallurgical grade (min. 80 percent CaF_2). An estimated 53 percent of total world production is used for the production of hydrofluoric acid (HF), a key intermediate in the production of a wide range of organic and inorganic fluorine based chemicals.

2. OCCURRENCES

Fluorspar is found in a wide range of geological environments across the globe. The primary economic source of fluorspar is in vein deposits, where it occurs as the main mineral or with metallic ores such as lead, zinc, silver and barites in particular. Vein deposits are found around the world and include the El Hemman deposit in Morocco, the Rosiclane deposit in United States of America (USA), Osor deposit in Spain and recently exploited deposits in China. Replacement deposits are associated with intrusive igneous rocks, such as the Rio Verde deposit, San Luis districts deposit in Mexico and Vergenoeg deposit in South Africa. Stratiform deposits are typified by cave; such as Illinois deposit in the USA. The world's reserves of fluorspar are estimated at 240 Mt. South Africa is the single largest holder of these reserves (17%), followed by Mexico's 13%, China's 10% and Mongolia's 9% (Fig. 1).

FIGURE 1: WORLD FLUORSPAR RESERVES, 2011



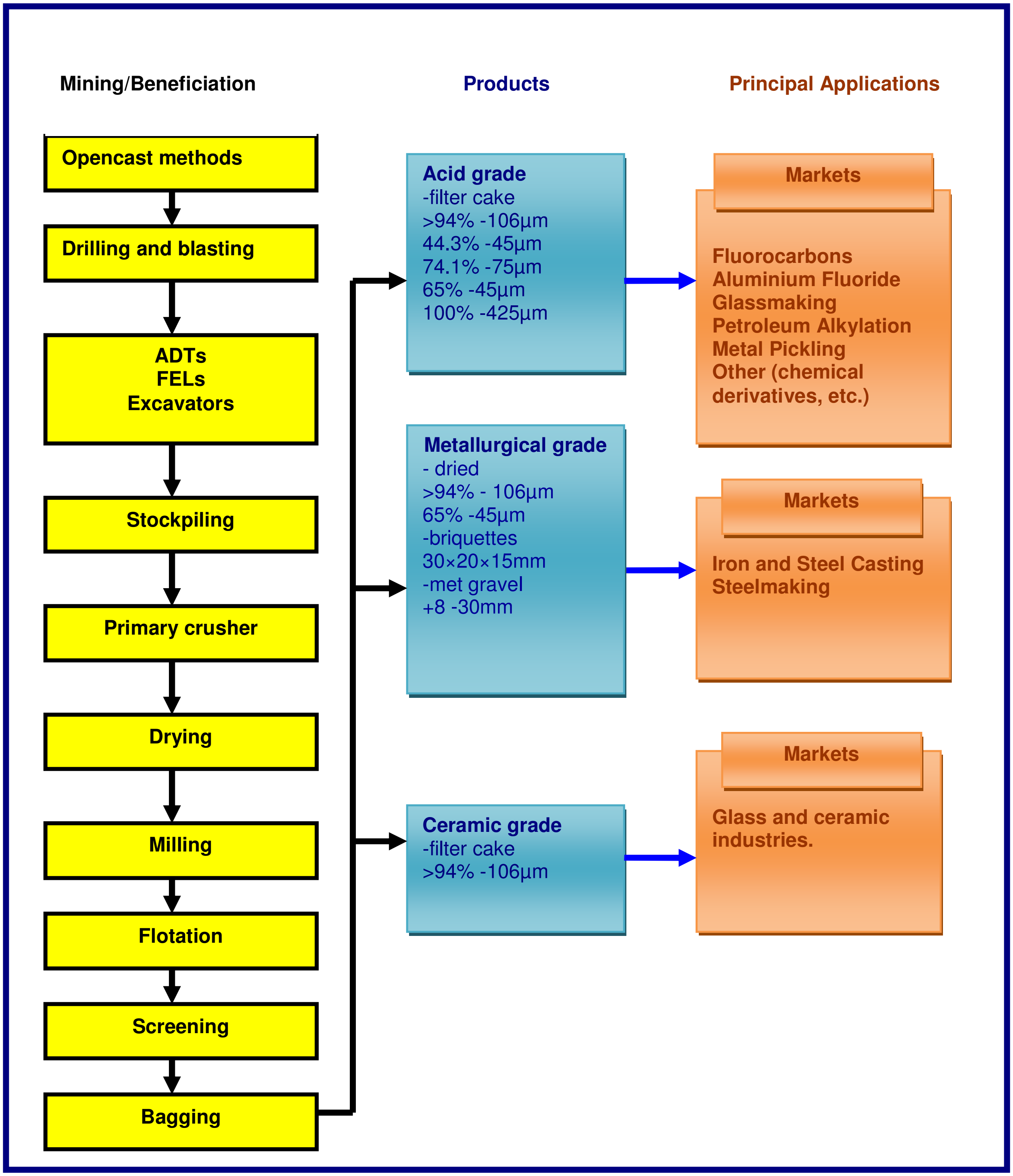
Source: USGS, 2012

3. PRODUCTION PROCESSES

Fluorspar mining methods vary according to geological conditions of individual deposits. Deep deposits usually require underground mining techniques while wide, shallow deposits and deep deposits where the ground is unable to support underground mining, despite a substantial overburden are usually mined by opencast methods. In mining the vein, shrinkage stoping is commonly used, but open stoping (removal of the ore with minimum waste from the footwall and hanging wall) can also be used, where strong walls occur. Room and pillar method is used in stratiform or bedded deposits. Replacement deposits are mined using the cut and fill method if the deposit is deep and narrow.

Fluorspar ore is commonly blended before use in order to maintain a constant feed grade to the beneficiation plant. The ore is crushed, washed and screened before processing (Fig. 2). Most modern plants use a combination of gravity and froth flotation processes. Gravity concentration uses liquids to separate the gangue minerals to produce either a coarse grained metallurgical grade fluorspar or to provide the feed for a flotation plant producing acid and ceramic grade fluorspar. Preceding flotation, the ore is ground very finely to liberate impurities and then fed into tanks containing an agitated chemical solution. The fluorite grains stick to the bubbles rising through the tank and overflows as froth. Lower grades fluorspar is produced in addition to the higher grade fluorspar. Lower grade concentrates can be sold as ceramic grade fluorspar or pelletized and sold as metallurgical grade fluorspar.

FIGURE 2: FLUORSPAR INDUSTRY FLOWCHART



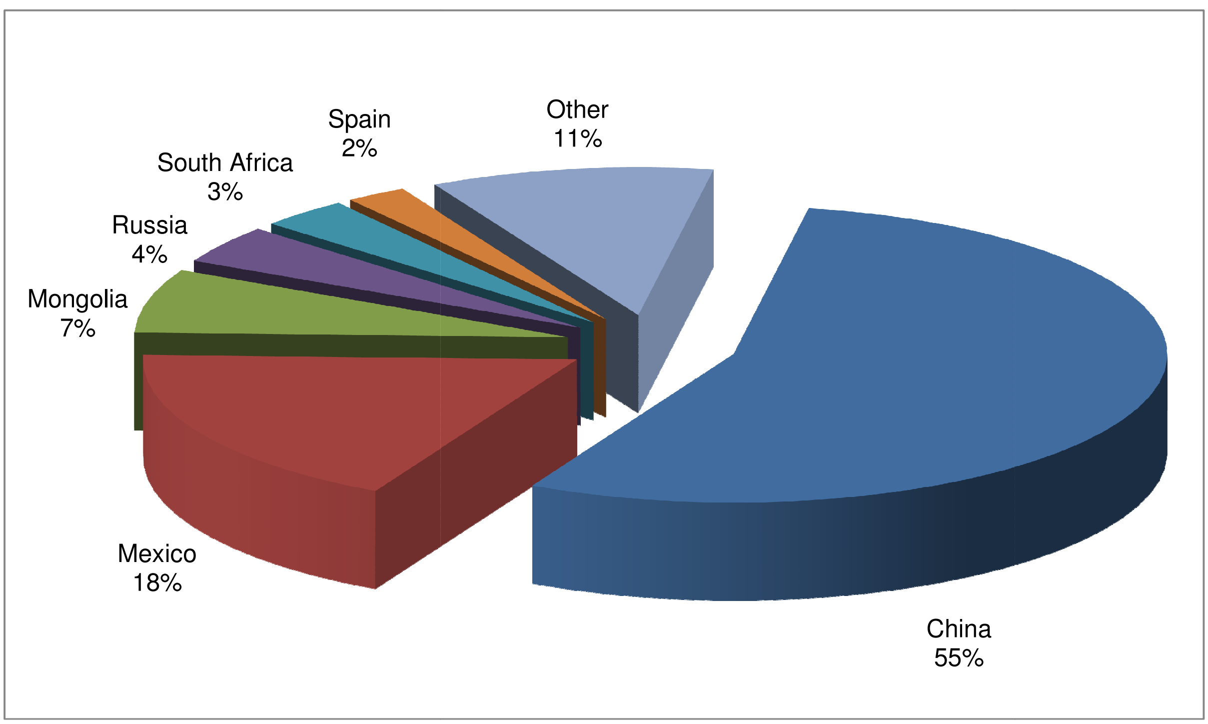
Source: DMR, Directorate Mineral Economics

4. WORLD SUPPLY

Total world production of fluorspar was estimated at 6.20 Mt in 2011. China and Mexico dominate the world fluorspar production accounting for approximately 55 percent and 18 percent respectively. Other important fluorspar producing countries include Mongolia (7%), Russia (4%) and South Africa (3%) (Fig. 3). World production of fluorspar has grown at an annualised compound growth rate of 3.0 percent from 4.43 Mt in 2002 to 6.20 Mt in 2011 (Fig. 4). Growth was driven by demand from the fluorochemical and aluminium industries. Some of African fluorspar producers that were forced to shut down in 2009 because of low demand and prices were able to resume production in 2010, despite the fragile market recovery.

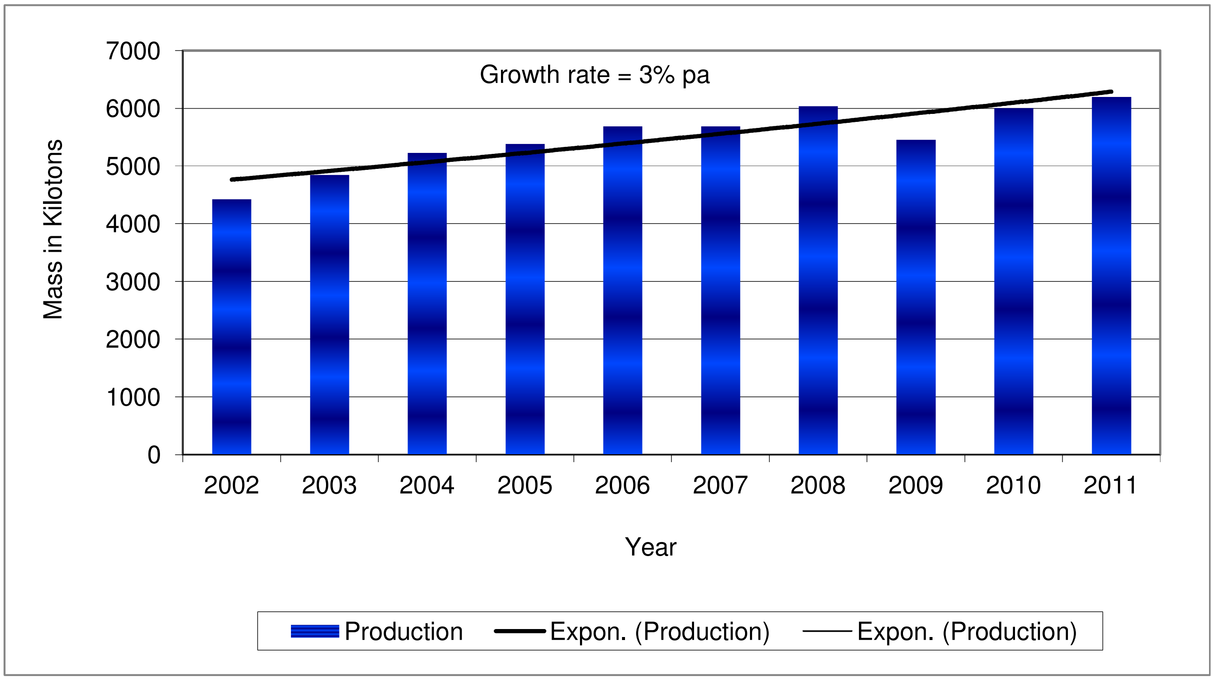
China has been the world leading producer over the last 20 years particularly through its infamous export quota system. The availability of Chinese material on the international market has decreased significantly over the past five years, as a result of the country's imposed quantitative restrictions in the form of export quotas, export license fees and export taxes in a bid to address domestic demand. The former restrictions were redundant and were abolished in the late 2009, following a complaint by European Union (EU), USA and Mexico to the World Trade Organisation (WTO). Mexico is an established and growing competitive producer of fluorspar and downstream fluorspar derived chemicals. Mexico moved to make up for the shortfall in the world's markets resulting from reduced exports by China, which spurred prospective developments in both established and new regions. It is likely that China will meet the bulk of any domestic supply deficit from Mongolia, a growing producer of fluorspar which, for western export markets, already transits through China. Even now the geographical focus of Chinese fluorspar consumption (HF plants) is shifting away from the southern provinces towards the Mongolian border.

FIGURE 3: WORLD FLUORSPAR PRODUCTION, 2011



Source: USGS, 2012

FIGURE 4: WORLD FLUORSPAR PRODUCTION GROWTH, 2002-2011



Source: USGS, 2012

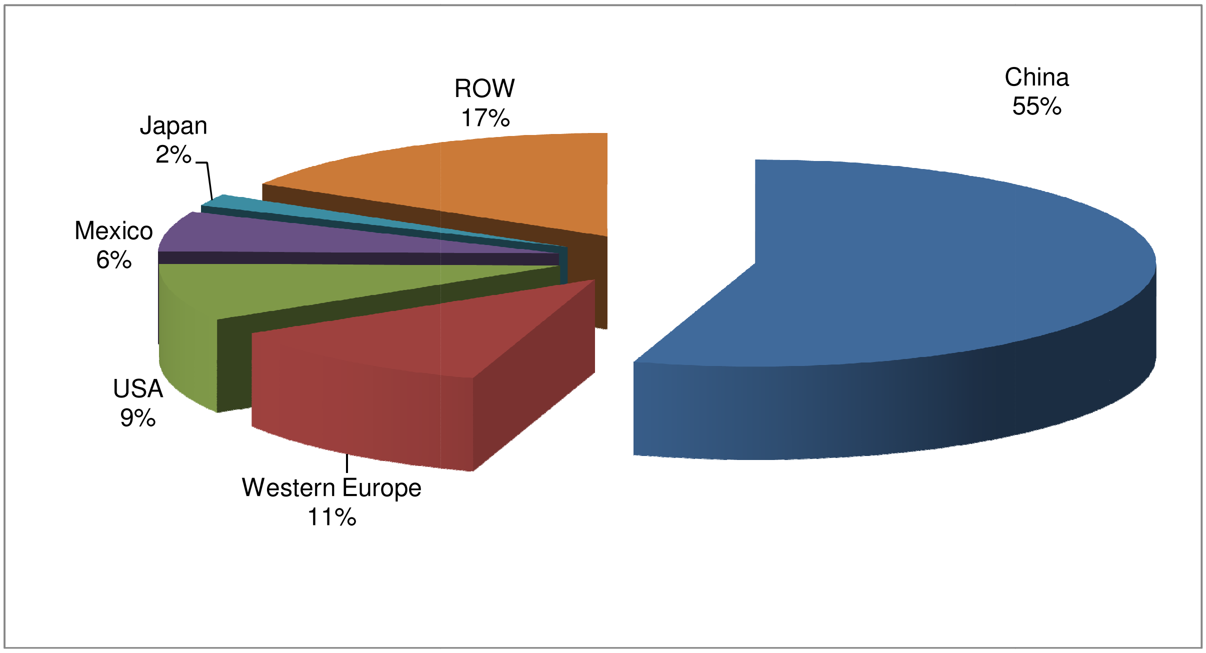
5. WORLD DEMAND

World consumption of fluorspar amounted to 5.6 Mt in 2010. Nearly two thirds of the world's fluorspar production is for the manufacture of HF, a feedstock for many different chemical processes. About one third of fluorspar produced worldwide is of metallurgical grade and is used primarily as a flux in steelmaking and in the production of aluminium.

There has been a significant shift in fluorspar consumption over the past 10 years marked by rising consumption in the Brazil, Russia, India, China (BRIC) countries, accompanied by falling consumption in Western Europe, the USA, Mexico and Japan. During this period, China's share of consumption increased from 32 percent to 55 percent and Western Europe declined from 19 percent to 11 percent while the USA and Mexico accounted for 9 percent and 6 percent respectively (Fig. 5). China is now the main consumer as well as producer of acidspar. The fluorspar market growth is driven by China, which has taken over the global manufacturing of downstream products. China has attracted massive foreign investments in recent years and has increased its exports of downstream products.

Demand for acidspar grew steadily from 2000 until 2007 fuelled by rising living standards in the developing countries (particularly BRIC countries), which pushed up demand for fluorspar's derived chemical products, particularly those used in refrigerants. In 2008, demand started to drop as a result of the international financial crisis and then collapsed in 2009, as consumers reduced stocks due to lack of demand across all end uses. Demand recovered slowly through 2010 and accelerated during the first quarter of 2011 as Chinese supplies became tighter.

FIGURE 5: WORLD FLUORSPAR DEMAND BY COUNTRY, 2011



Source: IHS Inc. 2011 (formerly known as SRI Consulting)

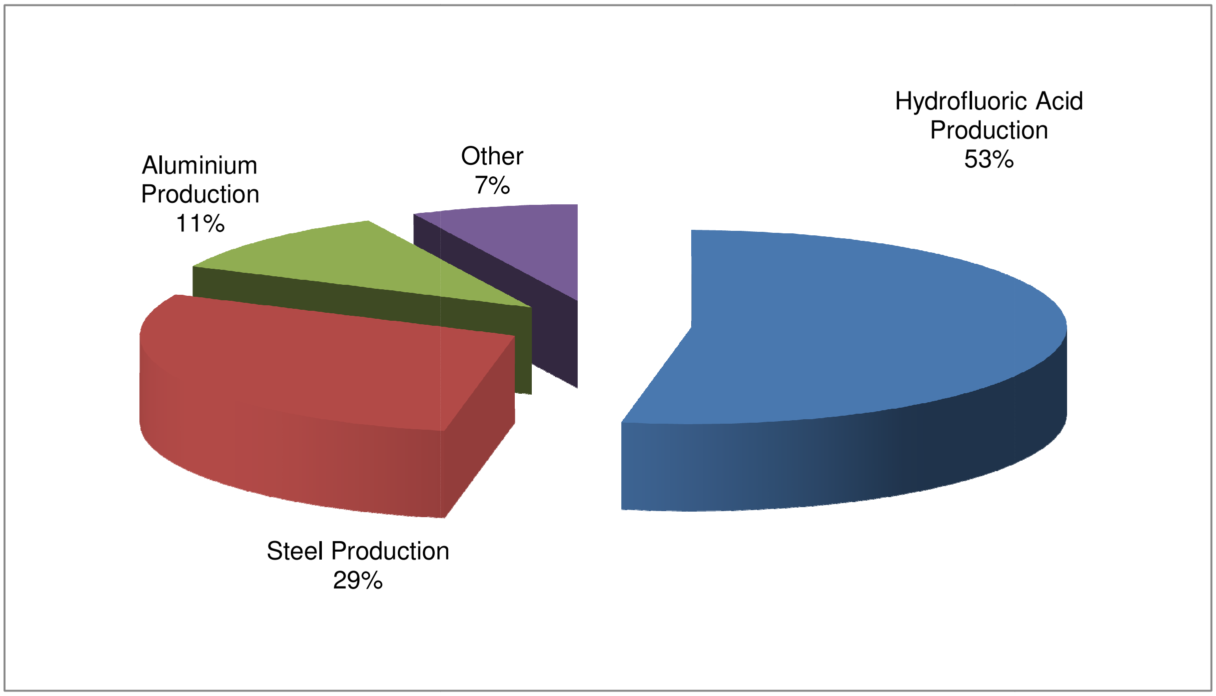
Note: ROW – Rest of World

6. WORLD MARKETS

The grade of fluorspar determines its end use. Approximately 60 to 65 percent of world fluorspar production is of acidspar and commands a significantly higher price than metspar. There is limited potential for inter-substitution between acidspar and metspar, since metspar is sold in large lumps, whereas acidspar is sold as a fine powder for chemical conversion to downstream products. Given its critical role in the fluorochemical, aluminium and steel sector, both the US and European Union (EU) have identified future fluorspar supply as crucial for economic stability. Fluorspar global market value is estimated at approximately $2.0 billion and the downstream market value is estimated at $112 billion (includes fluorochemicals).

Commercial fluorspar is graded according to quality and specification into metallurgical grade (min. 80 percent CaF_2), ceramic grade (min. 80-96 percent CaF_2) and acid grade (min. 97 percent CaF_2). HF is by far the largest market for global fluorspar supply, accounting for 53 percent of total world production (Fig. 6). This intermediate HF market serves numerous downstream chemical sectors, the largest being fluorocarbons with 45 percent of the HF segments. The second largest use of HF is in the production of aluminium fluoride (AlF3), which is the feedstock for synthetic cryolite (a flux used in aluminium production). Metal fluxes are also a major market for fluorspar outside the HF sector, with 29 percent of fluorspar total output consumed in production of steel (using metspar) and 11 percent used in aluminium production - using acidspar (Fig. 6).

FIGURE 6: WORLD FLUORSPAR MARKETS



Source: IHS Inc. 2011 (formerly known as SRI Consulting)

Acid grade fluorspar is used in the production of HF, mostly in China, the USA, and Europe. Acid grade fluorspar is also used in the production of aluminium. HF is a precursor in the synthesis of almost all fluorochemicals, mostly fluorocarbons. These fluorine containing chemicals are used as refrigerants (replacing CFCs), non-stick coatings, medical propellants, anaesthetics and in the production process of electronics, computer chips, printed circuit boards and thermal insulation. Metallurgical grade fluorspar is used primarily as a flux in steel making to reduce slag viscosity, to lower melting point and remove impurities from steel. It is also used in basic oxygen furnaces of carbon steel plants. Ceramic grade fluorspar is used in the glass and ceramic industries; smaller quantities are used in the manufacture of magnesium and calcium metals and welding rod coatings.

More than 90 percent of South Africa's production is exported to the leading fluorochemical producers namely Honeywell/du Pont (USA) and Bayer (Germany). Despite having the largest reserves of fluorspar, South Africa has a tiny share of the fluorochemicals market. South Africa beneficiates less than 5 percent, the local beneficiation drive will create opportunities to challenge the export market. However, developments such as Sephaku Fluoride's beneficiation hub will ensure that South Africa obtains better economic value from its fluorspar endowment. Since over 80 percent of world fluorspar production goes into hydrofluorocarbons (HFCs) and AlF3 manufacture, future demand for fluorspar will depend on end use markets such as refrigerants. The stringent environmental protection legislations regarding the use of chlorofluorocarbons (CFCs) were termed as the main cause for sluggish fluorspar demand. Growth of fluorspar is dependent on the use of HFCs as an alternative to CFCs. Further, prospects of non-ozone depleting refrigerants represent another major factor influencing fluorspar growth.

7. WORLD TRADE

For decades China has been the dominant supplier of fluorspar to western markets but in recent years Chinese exports have fallen substantially as China has grown its internal demand in the manufacture of downstream fluorine products. China, now the world's largest consumer of fluorspar, is likely to become a net importer in the next few years. Chinese global market share has been decreasing since 2007 due to higher export taxes imposed by the country to protect rapidly decreasing reserves and securing supply for domestic consumption. Until 2010, China continued to limit its exports to support its downstream fluorochemical industry, which have allowed other countries to make up the shortfall on world markets. The falling quota and the rising taxes shaped Chinese exports in the 2000s. In 2011 the export quota was removed (Table 1). The most prominent reason for this is the fact that China consumes most of its production domestically and many other of the smaller Mexican, Russian, German and Brazilian producers also avoid exporting preferring to serve local markets. Most fluorspar entering the international market is sold on long term contacts or through long-term supply arrangements.

However, the Chinese government has announced plans to restrict future production of fluorspar; owing to decreasing reserves and environmental pollution concerns. It is also continuing with its drive to close all small and inefficient mining and flotation operations. Meanwhile, to ensure access to global raw materials at undistorted market prices, fluorspar has been listed as one of 14 critical raw materials by the European Union Raw Material Initiative (RMI). The focus is to encourage more stable sources of fluorspar so that the industry can reduce its reliance on the rest of the world, particularly China. The export restrictions together with the rising interest in the commodity are likely to result in a flurry of investment activity in countries that are rich in this resource.

The World Trade Organization (WTO) dispute settlement panel ruled that aspects of China's export policies on several important industrial raw materials (including fluorspar) are inconsistent with China's WTO obligations. The panel recommended that China amends its policies to conform to its WTO obligations, but China had until September 2011 to appeal the findings. The WTO panel's findings were the result of complaints filed in 2009 by the European Union, Mexico and the United States about China's policy of applying export duties, export licenses, export quotas and minimum export prices on fluorspar and several commodities. Concerning China's argument that its export policies were justified on grounds of natural resource conservation, the panel found that China was unable to prove that it imposed such export restrictions while restricting domestic production or consumption of the raw materials in order to conserve the raw materials.

TABLE 1: CHINA EXPORT QUOTAS, 2002-2011

Year	Mass (kt)
2002	1 000
2003	850
2004	750
2005	750
2006	710
2007	685
2008	585
2009	585
2010	585
2011	0

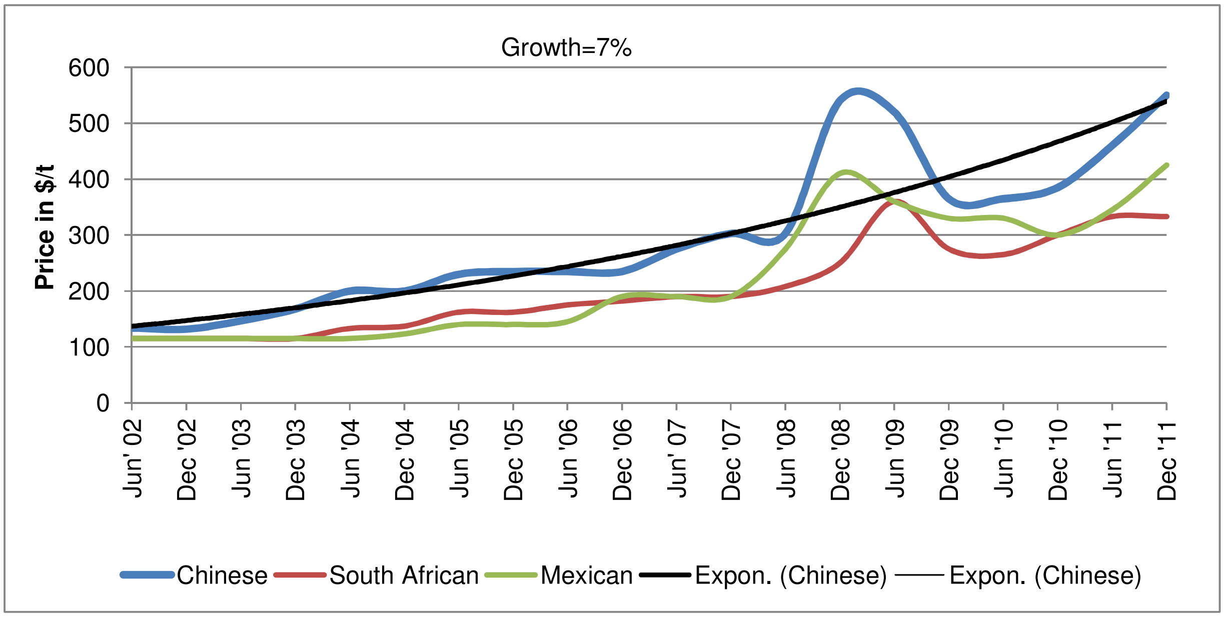
Source: MOFCOM, Global Trade Atlas

8. WORLD PRICES

Chinese prices have been used as the benchmark for world fluorspar prices in recent decades since the country is the dominant producer and exporter. Prices for Chinese fluorspar rose by 7 percent owing to increased production costs, appreciation of the Chinese yuan relative to the US dollar and the rising demand (Fig. 7). In 2010, the rise in prices was largely driven by the ongoing increase in raw material and production costs globally. Demand for both acid and metallurgical fluorspar grades was bullish in 2011, with price increases pushed through by a number of producers. Chinese and Mexican acidspar price levels breached the $500/t level which raised interest in new sources. South African acidspar prices continued to rise.

Rising prices of fluorspar have caused price increases for fluorspar derived products such as aluminium fluoride and fluoropolymers. This was due partly to stronger demand, limited output over the winter season, as well as the Chinese government's clampdown on fluorspar extraction and new restrictions on HF producers. Currency exchange rates and increases in handling and transportation costs were also contributing factors. Although prices for metspar and acidspar are currently pre-recession highs, prices could decrease as financial uncertainty returns to consuming sectors particularly aluminium and steel.

FIGURE 7: WORLD ACID GRADE FLUORSPAR PRICES, 2002-2011



Source: Industrial Minerals Magazine

9. SOUTH AFRICA

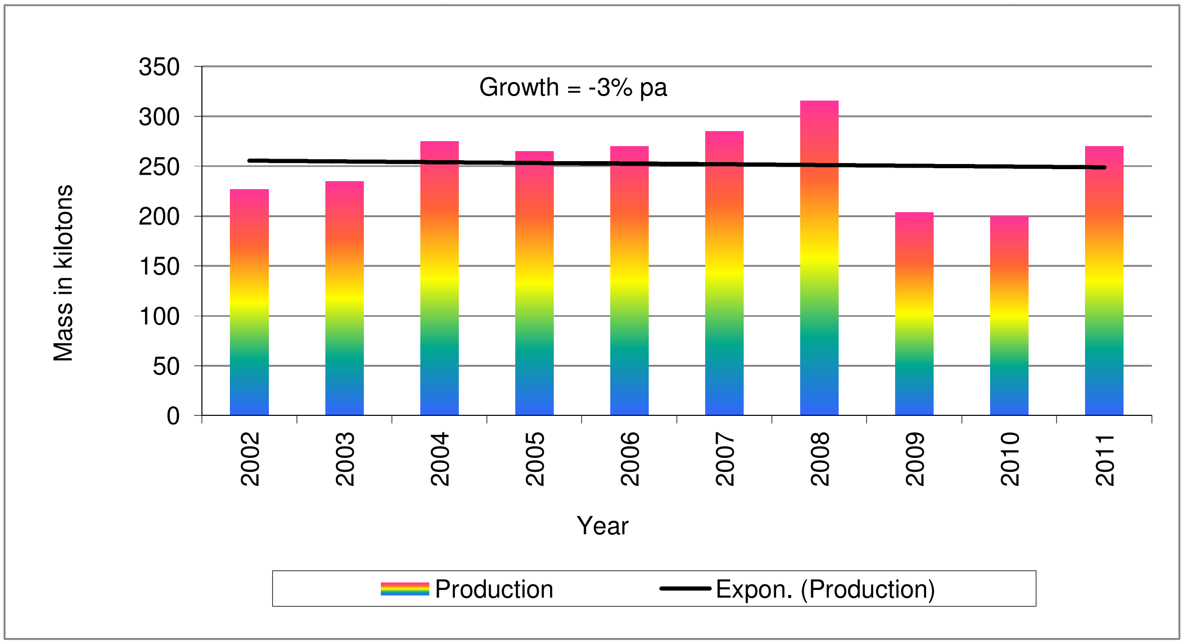
9.1. OCCURRENCES

South Africa is the single largest holder of fluorspar reserves in the world with most of these resources found in the Bushveld Complex – currently mined by Vergenoeg, jointly owned by Metorex (70% share) and Spanish company called Minerales y Productos Derivados SA (Minersa) with 30 percent share. Fluorspar deposits are also found in the Malmani subgroup of the Transvaal Supergroup, in the south western part of Marico District, south of Zeerust. At current reserve estimates, depletion rate of fluorspar was 0.7 percent based on 2011 production, giving these reserves a 152 years lifespan.

9.2. SUPPLY AND DEMAND

South Africa's production of fluorspar decreased at an annual rate of 3.0 percent for the past 10 years. Production decreased between 2009 and 2010 owing to curtailing and closure of mines that were not sustainable during low market price period (Fig. 8). In 2010, all mines were closed except Vergenoeg. Buffalo Fluorspar mine closed in October 2008 and Witkop Fluorspar mine in June 2009 as they were not economically viable to continue with operations. The restart of Witkop Mine operations in 2011 saw production increasing by 35.0 percent to 270 kt compared with 200 kt the previous year. Buffalo mine remained on care and maintenance with no plans to recommence operations in the near future. Total world production of fluorspar was estimated to be 6.20 Mt in 2011 and South Africa accounted for 3 percent.

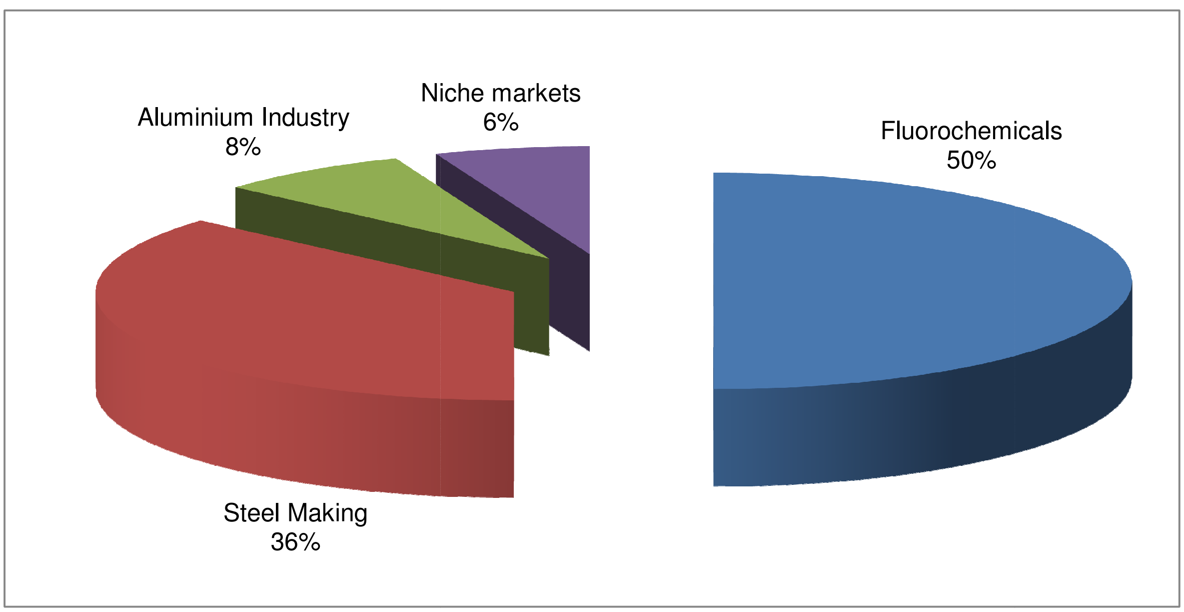
FIGURE 8: SOUTH AFRICAN PRODUCTION OF FLUORSPAR, 2002-2011



Source: DMR, Directorate Mineral Economics

The chemical market demand accounts for half of the total South African fluorspar demand, followed by steel making at about 35-38 percent which is fast diminishing while aluminium industry accounts for about 7-8 percent. Other small niche markets take the rest (Fig. 9). Each market has its own drivers and the global economy affects them all.

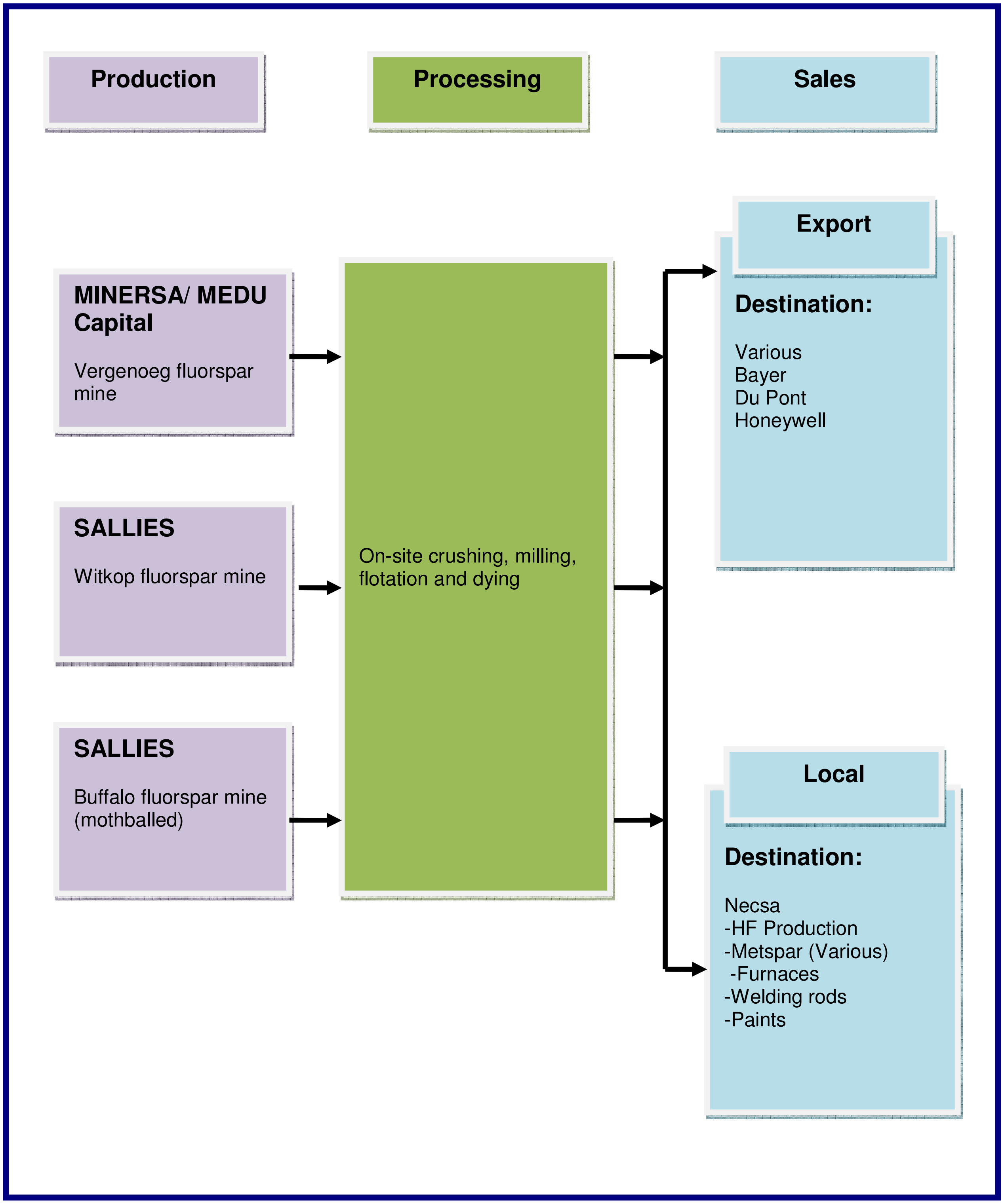
FIGURE 9: SOUTH AFRICAN FLUORSPAR MARKETS, 2011



Source: Vergenoeg Mine Pty, Ltd

Locally sales are mainly consumed by South African Nuclear Energy Corporation Limited (Necsa) which produces hydrogen fluoride (HF) and other downstream fluorochemicals, with smaller amounts used in metallurgical applications. The metspar is used for various applications as well as for furnaces, welding rods and paints (Fig. 10). Sales follow global economical trends and fluorspar market is very small, and as such it is very sensitive to the demand. Due to the temporary closure of some mines in 2009, which continued in 2010, the high prices made it profitable for the remaining producers. The market improvement in 2011, which enabled the reopening of some closed mines, will probably drive down the price again. Local market sales have remained steady. The South African fluorspar export market is primarily in Europe, where it is used in aluminium fluoride and hydrogen fluoride beneficiation. However, the downstream products are imported into South Africa at high cost (aluminium fluoride).

FIGURE 10: FLUORSPAR INDUSTRY AND COMPANY STRUCTURE



Source: DMR, Directorate Mineral Economics

10. RECENTS DEVELOPMENTS IN 2010/2011

Fluormin Plc (formerly Maghreb Minerals plc) positioned as an Africa-focused fluorspar producer and trader, following the acquisition of 63 percent stake in South Africa's Sallies and a 20 percent interest in Kenya Fluorspar Co., which operates the 100 kt per annum Kimwarer acidspar mine in Kenya, reopened in August 2010. Fluormin is majority-owned by two funds under control of New York-based Firebird Management with Firebird's holding totalling 65.9 percent. The deal provides Fluormin with overall control of Sallies 140 kt/a acidgrade fluorspar mine in North West province, which restarted operations in March 2011 after Fluormin provided $8 million in funding. Fluormin has also formed a fluorspar trading company, FluorOne Trading, taking a 49 percent interest in the joint venture. FluorOne exclusively represents Sallies for sales of fluorspar outside South Africa, with orders reported in China, Europe, India, Japan and North America.

Sallies Buffalo fluorspar mine and processing facility was mothballed in October 2008 and has since remained in care and maintenance with no plans to recommence operations in the near future. But fluorspar analysis shows that the current market prices were attractive enough to warrant the restart of Buffalo as Sallies has a great opportunity.

Sephaku Fluoride is a 100 percent subsidiary of Sephaku Holdings and its anchor project is based on the Nokeng opportunity, consisting of the Plattekop and Outwash Fan deposits situated near the world-renowned Vergenoeg fluorspar mine and the third identified deposit Wilton. Sephaku Fluoride is evaluating the establishment of a HF and AlF3 plant in South Africa, which will require 130 kt of fluorspar per annum by 2014 all of which will be sourced locally. Sephaku Fluoride, through Nokeng mine, will be a major supplier of fluorspar to this production facility following the commissioning of the Nokeng concentrator. The key technology to be utilised in the production facility will include the production of 60 kt per annum anhydrous HF from a feed of 130 kt per annum acid-grade fluorspar, and thereafter will produce 60 kt per annum AlF3. The production of AlF3 will consume 42 kt per annum of the HF produced and the balance of 18 kt per annum AHF will be available for sale to the market or to further develop the fluorochemical industry in South Africa.

Vergenoeg Mining Company finished commissioning a new drying and briquetting plant which is designed to produce the products required for the local market. The company has invested a lot in the plant to beneficiate the metspar on their site to saleable product. Vergenoeg now supplies about 100 percent of the local acidspar requirements and 95 percent of the local market metspar requirements. The company's currently working on possible initiatives to increase the briquetting plant in partnership with Pelchem and Industrial Development Corporation (IDC) to create a downstream Fluorochemical hub in South Africa. Initial discussions have been held with the Department of Trade and Industry (dti) and Department of Science and Technology (DST).

SA Fluorite Pty Ltd is a South African-based fluorspar developer with a promising deposit. Central African Mining & Exploration Co. plc (CAMEC) owns 51 percent interest in the Doornhoek fluorspar property in South Africa. CAMEC is a subsidiary of ferrochrome giant Eurasian Natural Resources Corp (ENRC). The company project, Doornhoek, contains in excess 50 Mt fluorspar at an average grade exceeding 20 percent CaF_2. The anticipated production target is 275 kt per annum. Fluorspar is currently listed on the strategic minerals list in the USA (4th) and Europe (11th).

11. OPPORTUNITIES FOR BENEFICIATION

Beneficiation entails the transformation of raw material, through the production process using local labour or capital resources, to a more finished product that has a higher value and is marketable to a much wider range of consumers, both locally and internationally. Fluorspar is a fascinating and particularly important mineral, with a myriad of downstream applications that are integral to a variety of vital industrial processes. Its primary use is in the production of HF, the main consumption of which is driven by the need for gas for refrigeration. HF is also used in the production of aluminium fluoride. This is used to significantly lower the melting point of aluminium and therefore reduce the costs in the production of aluminium in smelters. Furthermore, it is also used in the production of lithium batteries, fluorochemicals and uranium enrichment.

Fluorspar is one of the many mineral resources that are abundant in South Africa on which the country has never truly capitalised. Yet there has been a reluctance to invest in the technology and infrastructure required for its beneficiation. Despite, South Africa accounting for 18 percent of world's reserves, the country currently beneficiates less than 5 percent of its fluorspar total production into higher value fluorochemical products. This presents an opportunity for manufacturers to venture into the downstream value addition market on raw materials. South Africa has the opportunity to challenge the market by providing an alternative stream of beneficiated supply. The jobs created directly and indirectly are likely to have the greatest impact on South African communities, and will be supported by deliberate programmes for training and development, corporate social investment and local economic development.

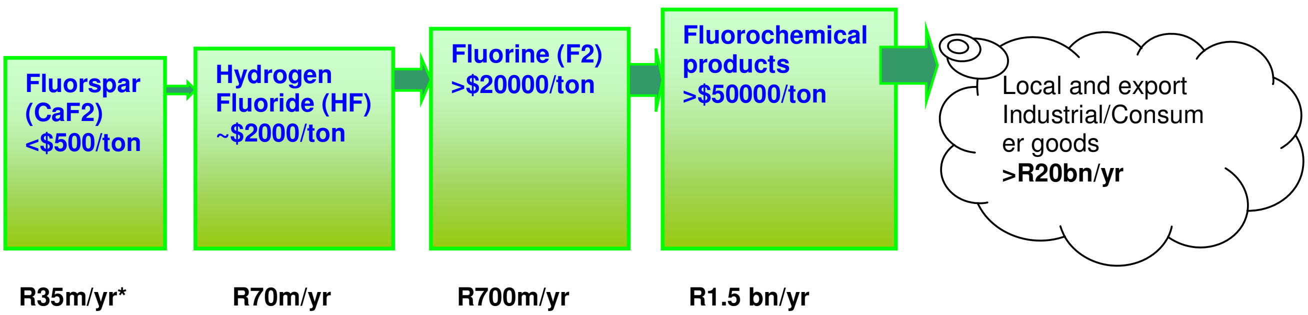
In March 2009, South African Nuclear Energy Corporation Limited (Necsa) subsidiary Pelchem launched a Fluorochemical Expansion Initiative (FEI) with the ultimate goal of creating fluorine-based new business ventures and firms that will support economic growth and development in South Africa. The fluorochemical expansion initiative is a priority project within government to develop the chemical sector in South Africa. Earmarked chemical products include fluoropolymers, elastomers, pharmaceuticals and semiconductors. Pelchem is currently the only company in the country that beneficiates a small percentage of locally mined fluorspar into higher value fluorochemicals as envisaged by FEI. The current production consumes around 10 kt per annum of fluorspar which is expected to remain the same for the next 3 years. FEI supports the Sephaku Project as well as the Alfluorco project. The main drive of this part of FEI is skills development, technology creation, international collaboration, etc. To date the project has supported 103 students and produced 133 published and conference papers and 7 patents.

The feasibility study, which resulted in these projects (HF/ATF) being initiated, was jointly funded by the Department of Trade and Industry (the dti) and Department of Science and Technology (Dst). The dti, Pelchem and the Industrial Development Corporation (IDC) is evaluating a multitude of new fluorochemical commercial opportunities for the country, most of which are aligned with strategic government programs of mineral beneficiation, the Industrial Policy Action Plan (IPAP2) and Integrated Resource Plan (IRP2).

As much as there are barriers to entry to the fluorochemical industry in terms of the technology involved, the potential for further downstream beneficiation presents attractive opportunities for new entrants in the market.

Figure 11 below, shows the fluorspar value chain including prices and costs. Fluorspar is fed as a raw material at a price of less than $500/ton costing R35 million per year, then beneficiated at the first stage to hydrogen fluoride, where its price is equivalent to $2 000/ton costing R70 million per year, the second stage beneficiation to fluorine, its price is greater than $20 000/ton costing R700 million per year, the third beneficiation stage to higher value fluorochemical products of greater than $50 000/ton costing R1.5 billion per year. The fluorochemical products will be sold locally and exported to generate revenue greater than $20 billion per year.

Fig 11: Fluorspar value chain including prices and costs



Source: Pelchem, 2011

**Based only for a 5000 tons/yr HF production*

The expected benefits for the country include:

- increased exports and an improvement on chemical trade deficit;
- stimulate the use of HF and fluorine in other mineral beneficiation initiatives;
- foreign direct investments and international collaboration in business and technology;
- growth and development of high level skills and technology;
- increase the beneficiation of key raw materials and minerals
- create skilled and semi skilled jobs with opportunities to establish various support industries and downstream businesses;
- secure source of key raw materials and skills for the country for potential strategic programs.

12. ENVIRONMENTAL IMPACTS

The Montréal Protocol is an international treaty that eliminates the production and consumption of ozone depleting chemicals such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform. In the early 1990's, these substances were replaced with fluorinated greenhouse gases (F-gases) which consist of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur texafluoride (SF_6). F-gases and certain HFCs, however, have an extremely high global warming potential and are being emitted at an increasing rate. For example, the refrigerant R134a (tetrafluoroethane) is a single HFC compound used in motor vehicle air-conditioners, has no effect on the ozone layer but has a global warming potential (GWP) of 1300. GWP is a measurement of how much effect the given refrigerant will have on global warming in relation to CO_2, where CO_2 has a GWP of 1.

The Kyoto Protocol, on the other hand, is an international treaty of the United Nation Framework Convention on Climate Change (UNFCCC). This treaty aims to stabilize the concentrations of 4 greenhouse gases (carbon dioxide, methane, nitrous oxide and sulphur hexafluoride) and 2 groups of gases (hydrofluorocarbons and perfluorocarbons).

As general global driver, the environmental issues are extremely relevant; the Montreal protocol (to protect the ozone layer) affected the demand as it banned the use of a number of high fluorspar consuming chemicals (due to the combination with ozone damaging chlorine), and then later the Kyoto protocol (on climate change) affects a number of other fluorochemicals as well.

The US Environmental Protection Agency (EPA) approved two hydrofluoroolefin (HFO) compounds as replacements for chlorofluorocarbons-HFO 1234ze and HFO 1234yr. HFO 1234ze, developed by Honeywell International Inc, has been approved for the use as a foam blowing agent. HFO 1234ze has a very low global warming potential (GWP), is non flammable and can replace existing high-GWP blowing agents such as hydrofluorocarbons (HFC) 134a and 152a. In the developed markets, HF is facing erratic demand due to environmental legislations and the subsequent phase-out of hydrochlorofluorocarbon (HCFC) including HCFC-141b in the USA and Europe in the near future. Most producers are introducing HFC substitutes, which consume more HF and are expensive and a decline in market share is expected due to other cheaper replacement such as carbon dioxide for foam blowing.

Asia was the only region, showing an increase in HF capacity. In the USA, production of HCFC-142b and HCFC-22 was stopped until 2010, with complete ban to be in place by 2020. Production of all other HCFCs would be halted by 2015 and banned by 2030. In Europe, especially Germany, the phase out schedules is even faster. The European Commission passed a legislation to bring down emissions of fluorinated gases into the atmosphere by at least 25 percent. The legislation forms part of the commission's endeavour to reduce green house emissions as required by the Kyoto Protocol on climate change.

13. OUTLOOK

The global market for fluorspar is forecast to reach 5.9 Mt by the year 2017, buoyed by revival in Chinese fluorspar exports, surge in economic activity and demand from end-use markets such as aluminium smelters and electric arc furnaces among others. Growing demand for aluminium in the automotive sector is attributed as a major factor driving growth in the fluorspar market. There is an increasing demand for fluorspar in the production of fluoroelastomers, fluoropolymers as well as partially fluorinated copolymers and polymers. Developing markets including China, Mongolia, Mexico and Russia will add further impetus to the overall growth in the foreseeable future. The recent debt crisis in Europe had negligible impact on the fluorine chemical industry in China and demand continues to be robust, with stable production levels.

Global demand is increasing outside China and the global economy is not good so there will be renewed competition among fluorspar producers. In an effort to conserve natural reserves, the Chinese government commenced a National Program of Mineral Resources, which ruled that mining can be carried out only with government consent and by companies backed by adequate resources. New and stringent industry standards were put into place for the manufacturers, leading to reduced fluorite production and consequently a slowdown of overall exports. However, despite the Chinese government’s policy on vertical integration of resources, China’s dominance as the world leader in fluorspar production will continue undiminished, with probable lead maintained in the exports market as well. However, Mongolia is becoming more prominent and could threaten China’s export position in the foreseeable future.

The only one thing clear from the last few years, it is that the fluorspar industry is changing. Producers, particularly of acidspar, are seemingly no longer content to be only raw material suppliers. Vertical integration of the Fluorochemical industry has been rapidly emerging over the last decade both forward, from raw materials producers and backwards from downstream chemical manufacturers. Essentially, raw material suppliers can either decide to carry on with their usual business and face encroachment on their markets as new suppliers bring their projects online or choose to downstream investment. Similarly, producers of the intermediate product HF must choose whether to remain the link in the middle of the supply chain or add value to their business. But investment is risky and it requires significant capital which is not easy to raise, post recession.

The mining industry, one of the job drivers in the New Growth Path, plays a critical role in the socio-economic development of the country. As part of addressing the triple challenge of poverty, inequality and unemployment, government has developed a beneficiation strategy, which seeks to provide opportunities in the downstream part of the mineral sectors. The South African government supports downstream beneficiation of minerals and the development of fluorochemical initiative in the country as well as the drive towards development of nuclear power stations. These developments are being promoted against the background of growing regional demand for fluorocarbon products throughout South Africa. Demand for HF in South Africa is projected to grow to 38 kt per annum. Fluorspar beneficiation was identified as a specific priority by the 2005 Chemical Sector Development Strategy of the Department of Trade and Industry (the dti). The FEI remains an important area of focus in the IPAP2 of the National Industrial Policy Framework (NIPF).

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